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GENUS *MICRASTERIAS* C. AGARDH EX RALFS, 1848 (CHAROPHYTA) - FROM ANDHRA PRADESH, INDIA

G. RAJESWARA REDDY AND S. SANDHYA RANI *

Department of Botany, Sri Krishnadevaraya University, Ananthapuramu, Andhra Pradesh 515 003, India

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Abstract

As a part of the present thesis work, an extensive survey was conducted across all 28 districts of Andhra Pradesh to study desmid diversity. Algal samples were collected from different freshwater bodies and screened for the occurrence of desmids. Among the various genera identified, the present publication focuses on the genus *Micrasterias*. A total of seven taxa were identified. Of these, two species, *Micrasterias pinnatifida* Ralfs and *M. foliacea* Bailey ex Ralfs. were previously reported from Andhra Pradesh. The remaining five species, namely *Micrasterias americana* Ehrenberg ex Ralfs, *M.crux-melitensis* Ralfs, *M. mahabuleshwarensis* J. Hobson, *M. thomasiana* W. Archer, and *M. tropica* Nordstedt are reported here as new distributional records for Andhra Pradesh.

Keywords: Genus *Micrasterias*, key to species, descriptions, distribution.

***Corresponding Author**
S. Sandhya Rani

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INTRODUCTION

Desmids are a diverse group of freshwater green algae belonging to the family Desmidiaceae under Order Zygnematals of Charophyta and are regarded as important components of aquatic ecosystems. They are well known for their remarkable morphological diversity, ecological significance, and sensitivity to environmental changes, making them useful indicators of water quality. Among the desmids, the genus *Micrasterias* C. Agardhis considered one of the most morphologically elaborate and taxonomically significant genus due to its highly ornamented and symmetrical cells. *Micrasterias* is characterised by flattened biradiated cells, semi cells partitioned by incisions into an apical lobe and two or more lateral lobes, lateral lobes in turn divides to form lobules of the secondary, third and fourth order. *It* is represented by 102 accepted species worldwide [1] and 20 species have been reported from India [2].

India possesses rich freshwater algal diversity, and several studies on desmids have been carried out from different regions of the country. However, investigations on the genus *Micrasterias* from Andhra Pradesh remain limited and fragmentary. Therefore, detailed taxonomic studies are essential for understanding the distribution and diversity of this genus in the state.

A total of seven taxa of *Micrasterias* were identified during the investigation. Among these, *Micrasterias pinnatifida* Ralfs [3]and *M. foliacea* Bailey ex Ralfs [2] were previously reported from Andhra Pradesh, while *Micrasterias americana* Ehrenberg ex Ralfs, *M.crux-melitensis* Ralfs *M. mahabuleshwarensis* J. Hobson, *M. thomasiana* W. Archer. and *M. tropica* Nordstedt are reported here for the first time from Andhra Pradesh as new distributional records. The present study contributes to the knowledge of the Genus *Micrasterias* in Andhra Pradesh and provides baseline information for future taxonomic and ecological investigations on freshwater microalgae in the region.

The present study contributes to the taxonomic knowledge of the genus *Micrasterias* in Andhra Pradesh and provides baseline information for future ecological and applied investigations. Accurate taxonomic documentation of freshwater microalgae may facilitate future biotechnological and pharmaceutical research, as precise species identification is essential for bioresource exploration [4, 5].

MATERIALS AND METHODS

Study Area

An extensive survey was conducted across all 28 districts of Andhra Pradesh, India, to investigate the diversity and distribution of desmids, with special reference to the genus *Micrasterias*. Sampling was carried out from a wide range of freshwater habitats, including ponds, lakes, reservoirs, canals, marshes,

paddy fields, ditches, and temporary rain-fed water bodies during different seasons of the study period. Ecological parameters such as habitat type, aquatic vegetation, and locality details were recorded during each field visit.

Collection of Samples

Algal samples were collected from freshwater habitats using a plankton net made of bolting silk net with a mesh size of approximately 20–25 µm. Periphytic and epiphytic desmids associated with submerged aquatic macrophytes such as *Utricularia, Limnophilia, Najas, Hydrilla*, and other aquatic plants were collected by gently squeezing the vegetation into clean polythene zip-lock covers.

The collected materials were transferred into labelled plastic bottles and preserved immediately in 4% formaldehyde solution for laboratory examination. Details regarding date of collection, locality, habitat characteristics, and associated aquatic flora were recorded systematically.

Laboratory Processing and Microscopic Examination

The preserved samples were brought to the laboratory of the Department of Botany, Sri Krishnadevaraya University (SKU), Andhra Pradesh, for detailed taxonomic analysis. Algae were stained with Anilin blue or Lugol's solution. Semi-permanent and temporary slides were prepared using glycerine and distilled water for microscopic observation.

Microscopic examination was carried out using an Olympus CH i20 bright-field binocular compound microscope. Morphological characters including cell shape, symmetry, semi-cell structure, lobes, sinus configuration, wall ornamentation, chloroplast arrangement, and other diagnostic features were carefully observed and recorded for identification.

Measurements of cells were taken in micrometres (µm) using an ocular micrometer. Microphotographs of the observed taxa were captured using a Sony Alpha 5000 digital camera. The obtained images were calibrated and scaled using the ImageJ software application for accurate morphometric analysis.

Identification and Taxonomic Treatment

Identification of *Micrasterias*C. Agardh ex Ralfs taxa were carried out based on detailed morphological observations using standard monographs, floras, and relevant taxonomic literature on desmids. Important references consulted during the study included the works of [6-18], along with other relevant taxonomic publications. The nomenclature and classification followed currently accepted taxonomic systems.

Documentation and Preservation

Representative specimens, preserved samples, photomicrographs, and taxonomic records were maintained in the Departmental Herbarium/Research Laboratory of the Department of Botany, Sri Krishnadevaraya University, for future reference and verification. Illustrations and photographic documentation were prepared for confirmation of species identity and comparative taxonomic studies.

RESULTS AND DISCUSSION

Key to the species:

1. Cells interlocked to form pseudo filaments ---------- *M. foliacea*.
1. Cells do not form pseudo filaments ----------2.
    2. Apex of polar lobe entire ----------*M. pinnatifida*.
    2. Apex of polar lobe with a median incision -------3.
3. Cells elliptic in shape, polar lobe notched andapiculate----------*M. thomasiana.*
3. Cells otherwise in shape, lobes radiate or horizontal----------4.
    4. Lobes radiate----------*M. crusx-melitensis*.
    4. Lobes horizontal----------5.
5. Lateral lobes of semi cells not incised---------- *M. tropica*.
5. Lateral lobes of semi cells incised into lobes----------6.
    6. Division (incision) only once forming two lobes----------M. *mahabuleshwarensis*.
    6. Division twice, ultimate lobes four----------*M. americana.*

Description of Species

Micrasterias americana Ehrenberg ex Ralfs, 1848: xix Published in: Ralfs, J. (1848). The BritishDesmidieae.The drawings by Edward Jenner, A.L.S. pp. [i]-xxii, [i], [1]-226, 35 pls. London: Reeve, Benham & Reeve, King William Street, Strand.

Cells sub hexagonal in outline, length 127 µm width 100 µm, sinus open, apex acute; semi cells 3 lobed, polar lobe moderately large, subquadrate at the base, divided at the apex to form denticulate secondary lobes, 2 shorter lobes arise from the base of apex on either side; Lateral lobes divided twice, third order lobes unequal with denticulate apex: polar and lateral margins dentate along their inner margins.

Distribution in India: Jammu & Kashmir and Uttar Pradesh

Distribution in Andhra Pradesh: Batrepalli, Sri Sathya Sai District.

Latitude: 14.238924°; **Longitude:** 78.184931°

Collection date and time: Sunday, 19/10/2025 09:40 AM GMT +05:30.

Micrasterias crux-melitensis Ralfs, 1848: 73, pl. IX [9]: fig. 3

Cells semi elliptic in outline, length 95 µm, width 85 µm, walls smooth, sinus open, with acute at apex, portioned by incisions into an apical lobe two and lateral lobes; apical lobe short, cylindrically elongate, sides parallel, widened at apex, apex broadly incised to form secondary lobes, secondary lobes diverge, bidentate; lateral lobes twice incised to form third order lobes, incisions wide, ultimate lobes bidentate.

Distribution in India: Manipur.

Distribution in Andhra Pradesh: Nandadevi Puram, Srikakulam District.

Latitude: 18.526245°; **Longitude:** 83.821655°.

Collection date and time: Monday, 08/12/2025, 04:03 PM (GMT +05:30).

Micrasterias foliacea Bailey ex Ralfs, 1848: 210, pl. XXXV [35]: fig. 3
Pseudo filamentous, cells rectangular, length 70 µm, width 82 µm, Sinus open, linear, narrow; semi cells rectangular, partitioned by incisions into an apical lobe and 2 lateral lobes, polar lobes with stout, short, with base quadrate base and parallel sides, deeply notched at apex forming 2 secondary lobes on either side, dentate at base of notch: Lateral lobes divide twice to form secondary and third order lobes, lobes denticulate at their apices.
Distribution in India: Common in all states.
Distribution in Andhra Pradesh: Nandadevi Puram, Srikakulam District.
Latitude: 18.526245°; **Longitude:** 83.821655°.
Collection date and time: Monday, 08/12/2025, 04:03 PM (GMT +05:30).

Micrasterias mahabuleshwarensis J. Hobson, 1863: 169, first fig. (as 'Mahabuleshwarensis') Published in: Hobson, J. (1863). Notes on Indian Desmidieae. Quarterly Journal of Microscopical Science 1863: 168-170, 2 figs.
Cells sub hexagonal in outline, length 142 µm width 102 µm, sinus widely open, U shaped, above the isthmus furnished with a protuberance; portioned by incisions into an apical and two lateral lobes; semi cells 3 lobed, polar lobe moderately cylindrically elongate, widely incised at the apex to form elongate denticulate lobes, lobes divergent, base of apex with 2 shorter lobes on either side; lateral lobes divided once forming divaricate secondary lobes, margins of secondary lobes denticulate, incision wide open, below the margins of secondary lobes, polar lobes, lateral lobes ornamented with denticulations; zygotespherical angular, walls smooth 57.5µm in size, with six spines, spines 30 µm long, denticulate at apex.
Distribution in India: Andaman & Nicobar, Kerala, Madhya Pradesh, Maharashtra, Manipur, Tamil Nadu and Uttar Pradesh.
Distribution in Andhra Pradesh: Thamballa Palli, Annamaya District.
Latitude: 13.85041°; **Longitude:** 78.312396°.
Collection date and time: Wednesday, 05/11/2025, 10:18 AM (GMT +05:30).

Micrasterias pinnatifida Ralfs, 1848: 77, pl. X [10]: fig. 3
Cells sub hexagonal, border than long, length 55 µm, width 60 µm, sinus open, with acute apex; semi cells 3 lobed, incision between the lobes deep and broad, polar lobe widely spreading, extremities narrow and bifid, apex straight or slightly retuse; lateral lobes horizontally placed, fusiform, attenuated with bifid apices.
Distribution in India: Common in all states.
Distribution in Andhra Pradesh: Common in all districts. Nandadevi Puram, Srikakulam District.
Latitude: 18.526245°; **Longitude:** 83.821655°.
Collection date and time: Monday, 08/12/2025, 04:03 PM (GMT +05:30).

Micrasterias thomasiana W. Archer, 1862: 239, pl. XII [12]: figs. 1-10 (as '*Thomasiana*')
Cells elliptic, length 300 µm width 250 µm, walls smooth, sinus deep, narrow and linear; semi cells 5 lobed, incisions among lobes narrow and slightly open; polar lobe elongate, slightly broader towards apex, sides convex at apex, apex notched at the centre, notch apiculate, outer angles bidenticulate: each lateral lobe divide thrice, ultimate lobules bidenticulate.
Distribution in India: Andaman & Nicobar Islands.
Distribution in Andhra Pradesh: Thamballa Palli, Annamaya District.
Latitude: 13.85041°; **Longitude:** 78.312396°.
Collection date and time: Wednesday, 05/11/2025, 10:18 AM (GMT +05:30).

Micrasterias tropica Nordstedt, 1870: 219, pl. 2: fig 15.
Cells sub hexagonal in outline, length 95 µm ,width 80 µm, sinus broadly open, V shaped, with acute apex, cell walls scabrous and dentate; semi-cells 3 lobed, possess 2 rows of teeth along median plane, incision widely broad, polar lobe border at base and narrowed toward apex and diverge on both sides to form short denticulate lobes ending with four teeth, apex truncate, possess two strong teeth below it; lateral lobes horizontally placed, fusiform, attenuated, apices with four teeth, margins denticulate, inter marginally teeth extend along margins.
Distribution in India: Gujarat, and Madhya Pradesh.
Distribution in Andhra Pradesh: Srikakulam (Nandadevi Puram).
Latitude: 18.526245°; **Longitude:** 83.821655°.
Collection date and time: Monday, 08/12/2025, 04:03 PM (GMT +05:30).

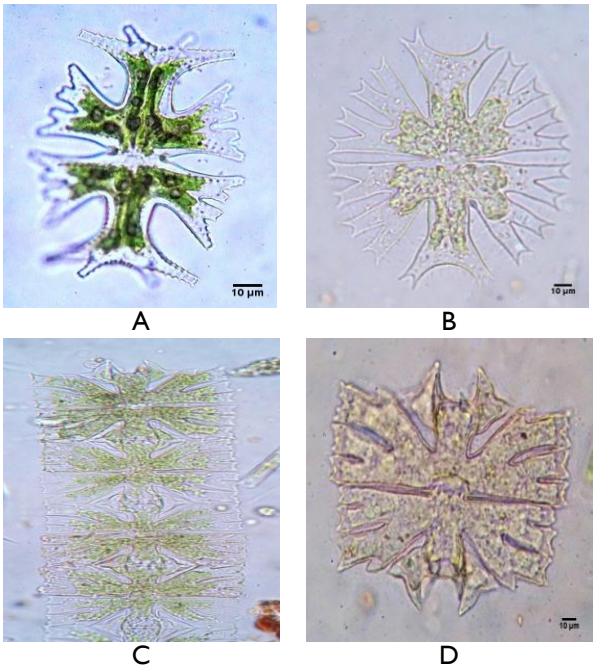

Plate 01:A. *Micrasterias americana* Ehrenberg ex Ralfs; B. *M. crux-melitensis* Ralfs; C–D. *M. foliacea* Bailey ex Ralfs: C. pseudofilament; D. single cell.

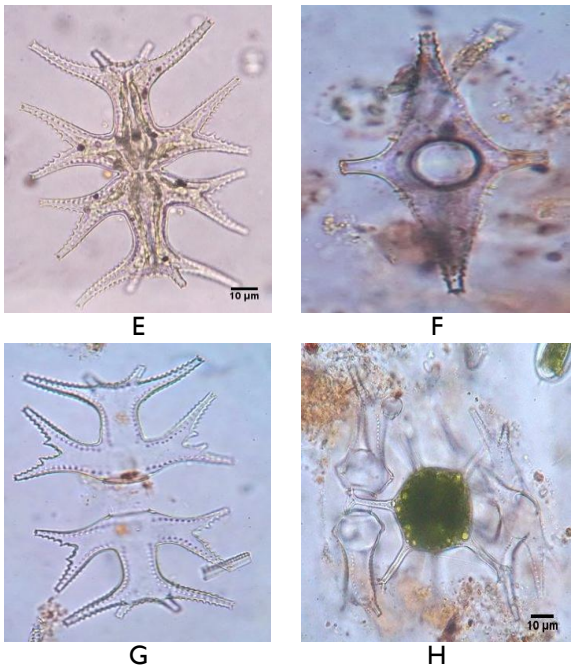

Plate 02: E–H. *M. mahabuleshwarensis* J. Hobson: E. cell; F. top view of cell; G. skeleton of cell; H. zygote.

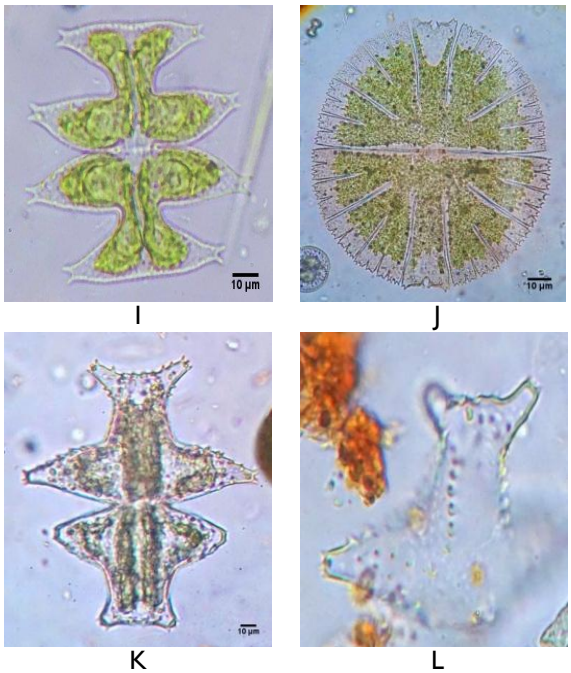

Plate 03: I. *M. pinnatifida* Ralfs; J. *M. thomasiana* W. Archer; K–L. *M. tropica* Nordstedt: K. cell; L. polar lobe showing teeth.

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INFORMED CONSENT STATEMENT

Not applicable. This study did not involve human participants.

ETHICAL STATEMENT

This study did not involve human participants or animals. Therefore, ethical approval was not required.

AUTHOR CONTRIBUTIONS

G.R.R.: Conceptualization, field survey, sample collection, laboratory analysis, identification of taxa, data collection, manuscript preparation.

S.S.R.: Supervision, validation of taxonomic identification, manuscript review, editing, and overall guidance of the study.

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